

ON DESERT SAND-DUNES BORDERING THE NILE DELTA.¹

THE distribution of desert sand-dunes in the neighbourhood of the Nile Delta is remarkable. They form a fringe to the desert (where the latter supplies a suitable sand), the material being piled up in dune-tracts, or dune-massifs, where-

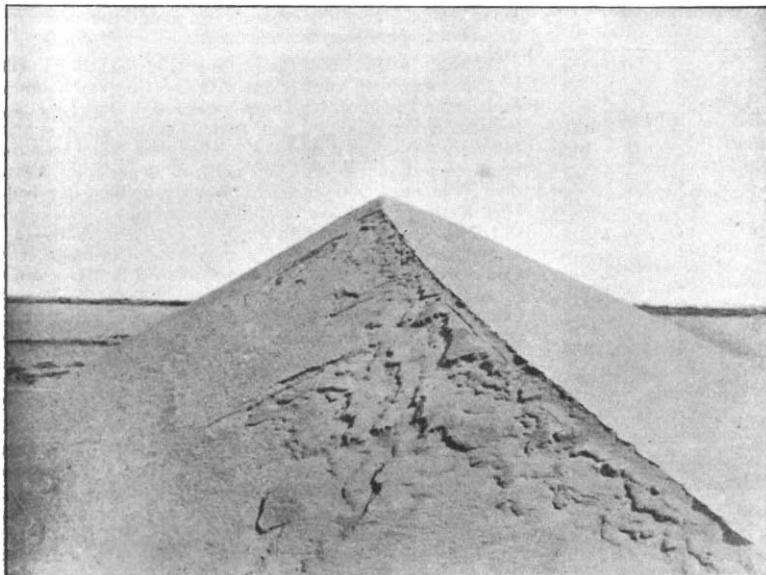


FIG. 1.—Pyramidal Dune.

ever its flow is locally checked by ground moisture. The water seeps up through the sandhill, keeping it moist and compact nearly to the surface. The ground plan of the dune-massif has little relation to the wind, which, however, playing upon the surface, throws it into waves. A typical example of the progressive development of their form appears to be as follows. First, a gently-rounded swell, then the lee side becoming rather steeper and the summit of the swell no longer central, but nearer the lee side: the eddy under the lee slope gathers strength and begins to undercut the bank of sand, causing it to slip, forming a straight cliff. This process continues until the eddy has cut back to the summit of the growing dune, which is then of nearly equal average steepness on windward and on lee side. The windward side is, however, a smooth curve of compact sand, whereas the lee side consists of two portions, the upper a straight cliff of loose sand, the lower a curved surface of tolerably compact sand. It is common to find the central portion of a dune showing the fully-developed, the ends the embryonic form. Where the eddy cuts down to a hard bed, the slipping cliff may constitute the whole of the lee slope.

The ratio Length/Height of blown ripples of sea-shore sand (which the author found to be about 18 : 1) holds equally for desert sand. Where, however, the air has an upward motion relatively to the surface, the ripples appear to be somewhat steeper, their front is less regular, their crest more nearly central, and they grow to greater amplitude, chiefly by excavation. A tract of small but perfect dunes (formed by the wind blowing upon dried Nile sand) was examined in order to see if there were any systematic

connection between height and length, such as exists in blown sand ripples. The individual transverse ridges were markedly undulating, and, the low portion of one ridge not corresponding with the low portions of the succeeding ridges, it was evident that there was no such simple relation of Length/Height as in the case of ripples. A line, however, having been marked out in the up-and-down-wind direction across twenty-three of the small dunes, it was found that the average ratio Length/Height along the line was identical with that of the ripples. Wherever a depression occurs, the wind is concentrated, and the depression tends to increase. On the other hand, wherever the amplitude is slightly greater, the eddy is stronger, and increases the amplitude. The measurements show that in these dunes the two processes proceeded at the same rate. Although in this sense equal and opposite, the two processes combine to produce modification of form. Thus, the sweeping round of the sand from two depressions leaves the bare ground on leeward of the intervening part of the ridge surrounded by sands of such shape that the pit looks like the hoof-print of a giant horse. These are the structures known as Fuljes, the origin of which has been much discussed. If the wind continue with diminishing supply of sand, the crescentic dune called Barchan would remain, the windward slope of the Fulj being the lee slope of the Barchan. Barchans, however, are not necessarily, nor usually, formed in that manner.

The author describes the operations of the Suez Canal Company in planting *Casuarina* trees to arrest the drift of sand which at present finds its way into the canal. The *Casuarina* does not require

rain, and its roots are capable of drawing moisture from a considerable depth. Indifferent as it is to drought, it can endure with equal indifference an excess of water at its roots, an



FIG. 2.—*Casuarina* Plantation.

important matter in the Government plantations on the west of the Delta, where periodical inundation has to be reckoned with. The *Casuarina* grows rapidly, and at Ismailia has attained a height of nearly sixty feet in twenty-five years. The foliage is light and feathery, waving confusedly and cheating

¹ Abstract of a paper read before the Royal Geographical Society, Nov. 29, 1899, by Mr. Vaughan Cornish, published in the *Geographical Journal*, Jan., 1900. The illustrations are reproduced from the *Geographical Journal*.

the wind of its force. It is anticipated that the long lines of plantation bordering parts of the Suez Canal will check the drift of the sand from the west, causing it to pile up in a rampart parallel to the canal. The trees should live and grow even when nearly buried in sand, being nourished by the water at their roots.

The largest of the dunes described by the author are those bordering the old Pelusiac branch of the Nile, eastward of the Suez Canal. The height of these dunes is reckoned at 300

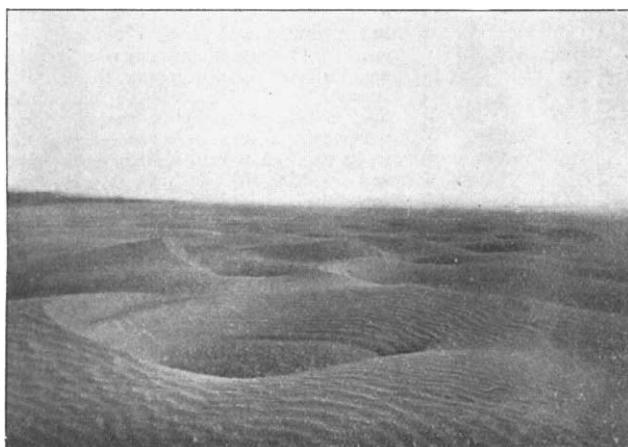


FIG. 3.—A Fulj.

feet and upwards. Once enveloped within the labyrinth of sandhills, however, the dimensions appear to be much greater. Under a low sun the scenery is especially remarkable. The startling contrast of light and shadow, the absence of detail on the smooth surfaces of pure blown sand, the steep slopes and bold forms, together with great clearness of definition and a death-like stillness, combine to produce a mountainous impression. It requires an effort of reason to correct the illusion of being surrounded by mountains of three thousand metres rather than by hills of three hundred feet.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. Frederic Harrison has been appointed Rede Lecturer for the present academical year.

The Chancellor has given official interpretations of certain statutes, respecting which doubts had been raised by the Council of the Senate. It appears that a Deputy Professor is declared competent and bound to perform all the functions of the Professor, and that it is not possible for the latter to reserve or to resume any of his duties during the term for which the Deputy is appointed. It also appears that the statutes give the University no power to forbid Readers or Professors from taking private pupils.

The grace for limiting the scope of Part I. of the Mathematical Tripos was rejected by 151 votes to 130; and that for abolishing the order of merit, and with it the Senior Wranglership, was rejected by 161 votes to 129. A considerable number of non-resident members of the Senate attended to register their votes. The other readjustments proposed by the Mathematical Board, chiefly affecting Part II. of the Tripos, were carried without a division.

WE learn from *Science* that the Regents of the University of California have adopted the policy of giving the professors of the University one year's leave of absence in seven. The Sabbatical year is widely recognised by American universities, and the opportunity it affords the professors of visiting distant countries and fellow-workers is invaluable. The custom could be introduced with advantage in our own universities and colleges.

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THE London *Technical Education Gazette* announces that botanical gardens have been laid out in Battersea, Ravenscourt and Victoria parks. Good collections of plants, representing various natural orders, have been obtained, and the more important trees and shrubs in the parks have been labelled. These gardens have been specially provided for the use of teachers and students of botany. Teachers who desire to obtain tickets should apply to the secretary of the Board, 116, St. Martin's-lane, W.C., giving their names in full and the name of the school where they are teaching.

AT the distribution of the prizes and certificates gained by the students in connection with the City and Guilds of London Institute, on Thursday last, Sir Douglas Fox, addressing the students, said that to specialise in study too early was a great mistake. The great point was to lay the foundation as wide and as broad as possible. That done, the next thing was to properly apply what had been learned. Mr. Watney afterwards made a statement as to the results obtained during the past year, and mentioned that in one way or another the Clothworkers' Company had subscribed 85,000*l.* towards the maintenance of the institute. At the invitation of the Royal Commissioners appointed by Parliament to reorganise the University of London, the executive committee have recently accepted the position of a "school of the University" for its Central Technical College.

THE results of an inquiry into the development of technical education in connection with English Secondary Schools during the past decade, made by the National Association for the Promotion of Technical and Secondary Education, are given in the current number of the *Record*. It appears from the report that in England alone, since 1889, 81 new public secondary schools have been established, while 215 existing schools have been extended mainly for the purposes of science teaching. As regards the schools in the latter category, the extensions to 195 of them have resulted in the addition of 251 physical and chemical laboratories, 77 workshops for manual training, 76 lecture-rooms, and 50 class-rooms. The total sum of money involved by these developments is 764,449*l.* Of this sum, local authorities have voted an amount of 147,496*l.*, the rating and borrowing powers of the Technical Instruction Acts being utilised to raise 20,707*l.* and the Residue Grant supplying the remainder. Taking technical and secondary schools together, as many as 664 schools have been affected by the efforts of County and County Borough Councils and other municipal authorities and of responsible public committees. Of this number of technical and secondary schools, 385 have been or are being established, while there are 279 existing schools which have been or are being extended or adapted. The capital expenditure incurred for these purposes now reaches in the aggregate 3,302,221*l.*, of which a sum of 1,896,110*l.*, or 57½ per cent., has been or is being supplied by local authorities from Imperial Funds or from local rates.

SCIENTIFIC SERIALS.

Bulletin of the American Mathematical Society (December 1, 1899—January 2, 1900).—(1) The proceedings of the October meeting in New York City are summarised, and abstracts of some of the twelve papers read are given by Prof. F. N. Cole.—Note on the simply transitive primitive groups, by Dr. G. A. Miller, contains some theorems and corollaries which are closely connected with a paper by the author in the *Proceedings of the London Mathematical Society* (vol. xxviii, pp. 533–544). The same writer contributes a short note on the commutators of a given group. Two theorems given are, every substitution of the alternating group of degree n ($n > 4$) is a commutator of two substitutions of the same group. "If the order of a cyclical group is odd, it is the commutator sub-group of its holomorph, and all its operators are commutators of this holomorph. When this order is even, the commutator sub-group of the holomorph includes half of the operators of this cyclical group, and all these operators are commutators of this holomorph." These results are partly supplementary to those contained in Dr. Miller's paper on the commutator groups (*Bulletin*, vol. iv.).—Dr. Lovett gives an account of Oltramare's Calcul de généralisation. From it we learn that this is the magnum opus of the writer, who is probably